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Drake et al.

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(54) **HIGH FLOW INTAKE SYSTEM FOR SUBMERSIBLE PUMPS**

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(51) **Int. Cl.**
E21B 43/00 (2006.01)

(52) **U.S. Cl.**
USPC ... **166/75.11**; 166/68.5; 137/597; 137/565.26

(58) **Field of Classification Search**
USPC 166/68.5, 75.11; 137/597, 565.26
See application file for complete search history.

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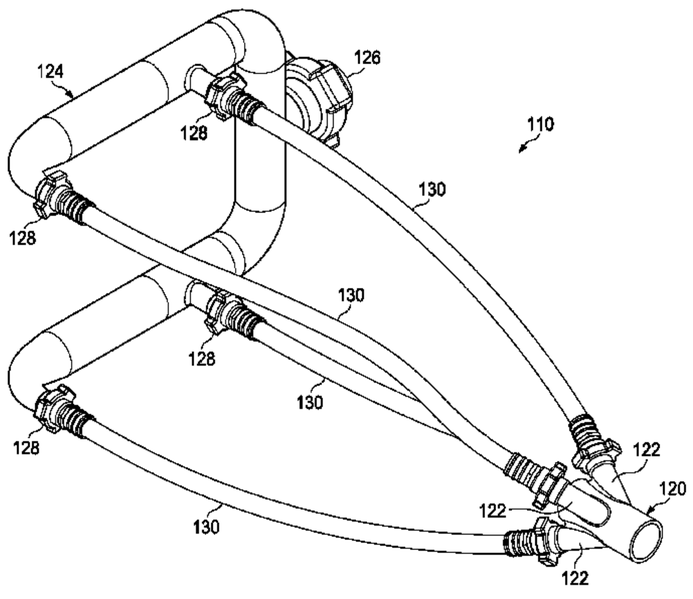
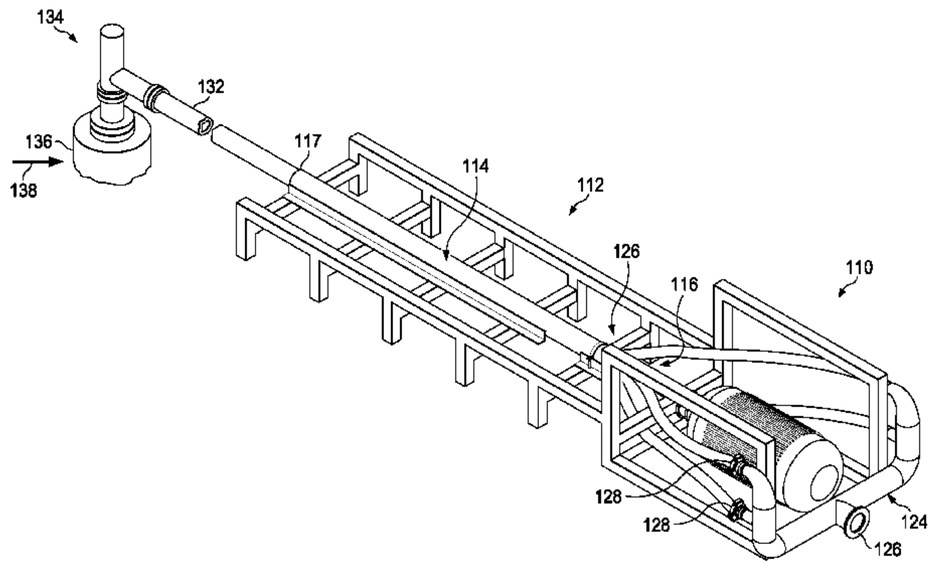
(57) **ABSTRACT**

A high flow intake system for a horizontal pump skid installation is provided for reducing cavitation and for eliminating a necessity to have a booster pump. A pump inlet assembly has a collar that is affixed to a horizontal pump body proximate a pump intake. The pump inlet assembly has a plurality, e.g., four, inlet members that protrude from the collar member at an angle, preferably, 30 degrees, from a longitudinal axis of the pump body. Each of a plurality of hoses is connected to one of the plurality of inlet members. A distribution manifold has an inlet and a plurality of outlets that receive the second ends of the hoses. Preferably, each of the hoses has a length that is at least 20 times an inner diameter so that fluid passing through each of the hoses develops laminar flow.

12 Claims, 6 Drawing Sheets





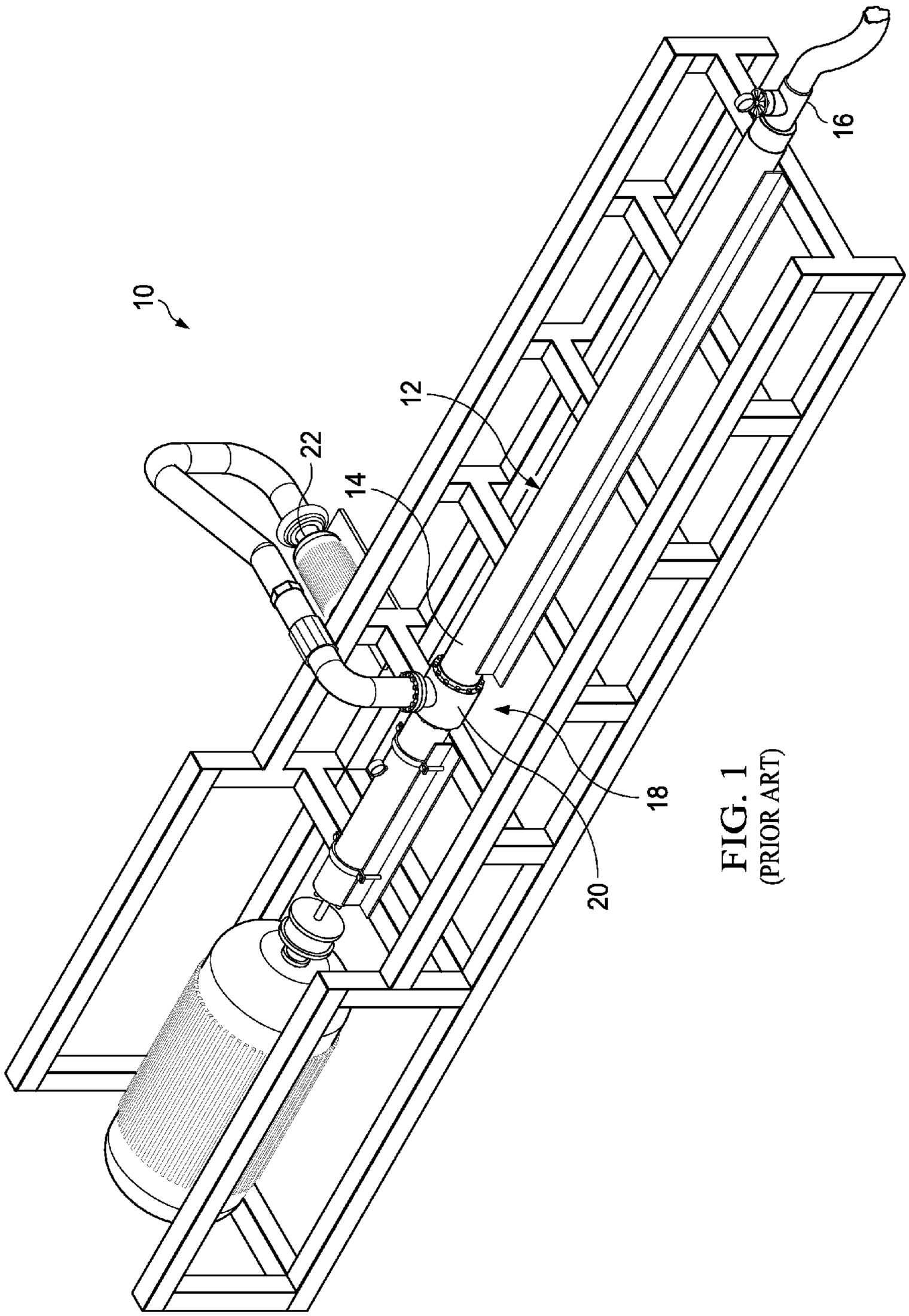


FIG. 1
(PRIOR ART)

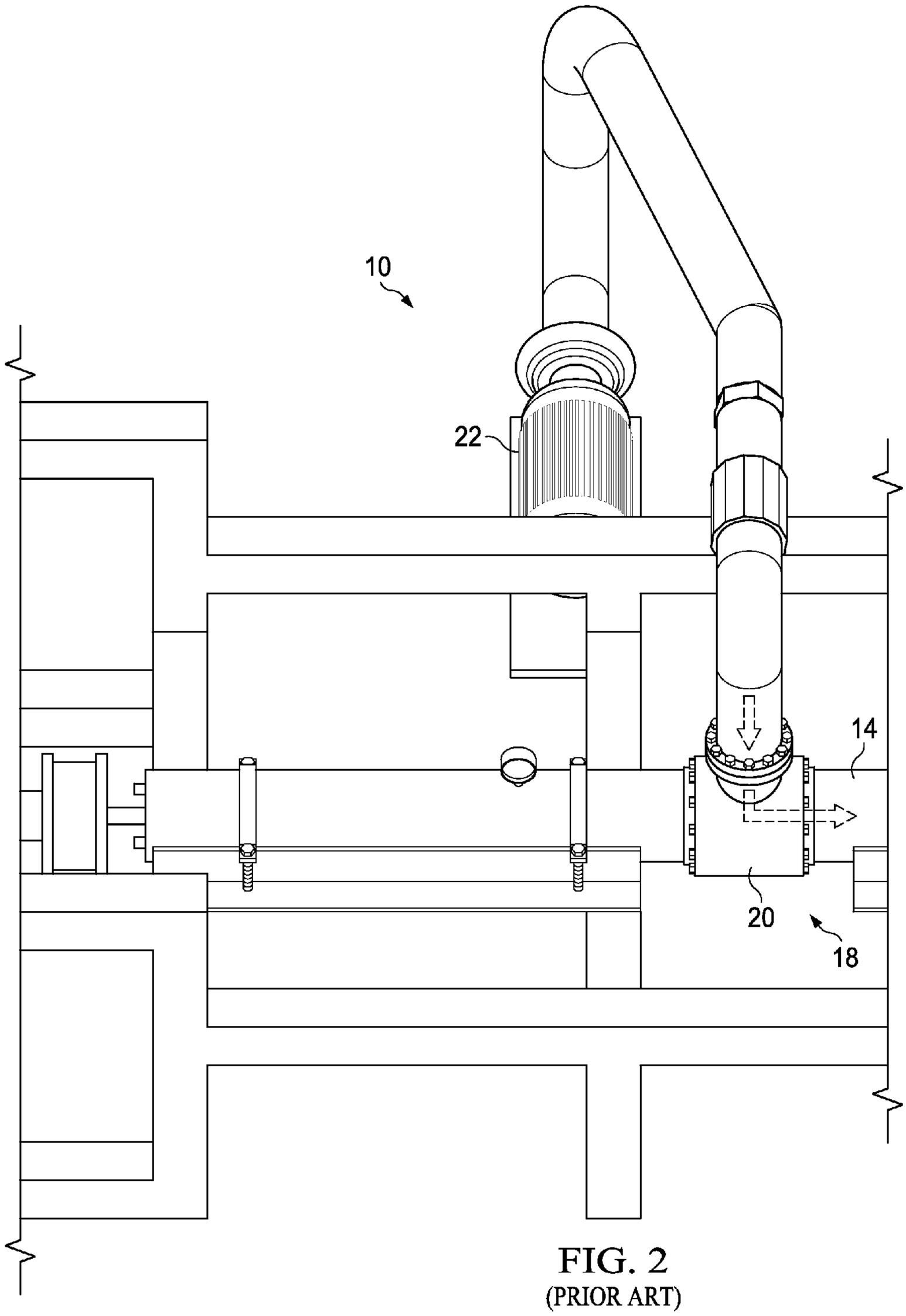


FIG. 2
(PRIOR ART)

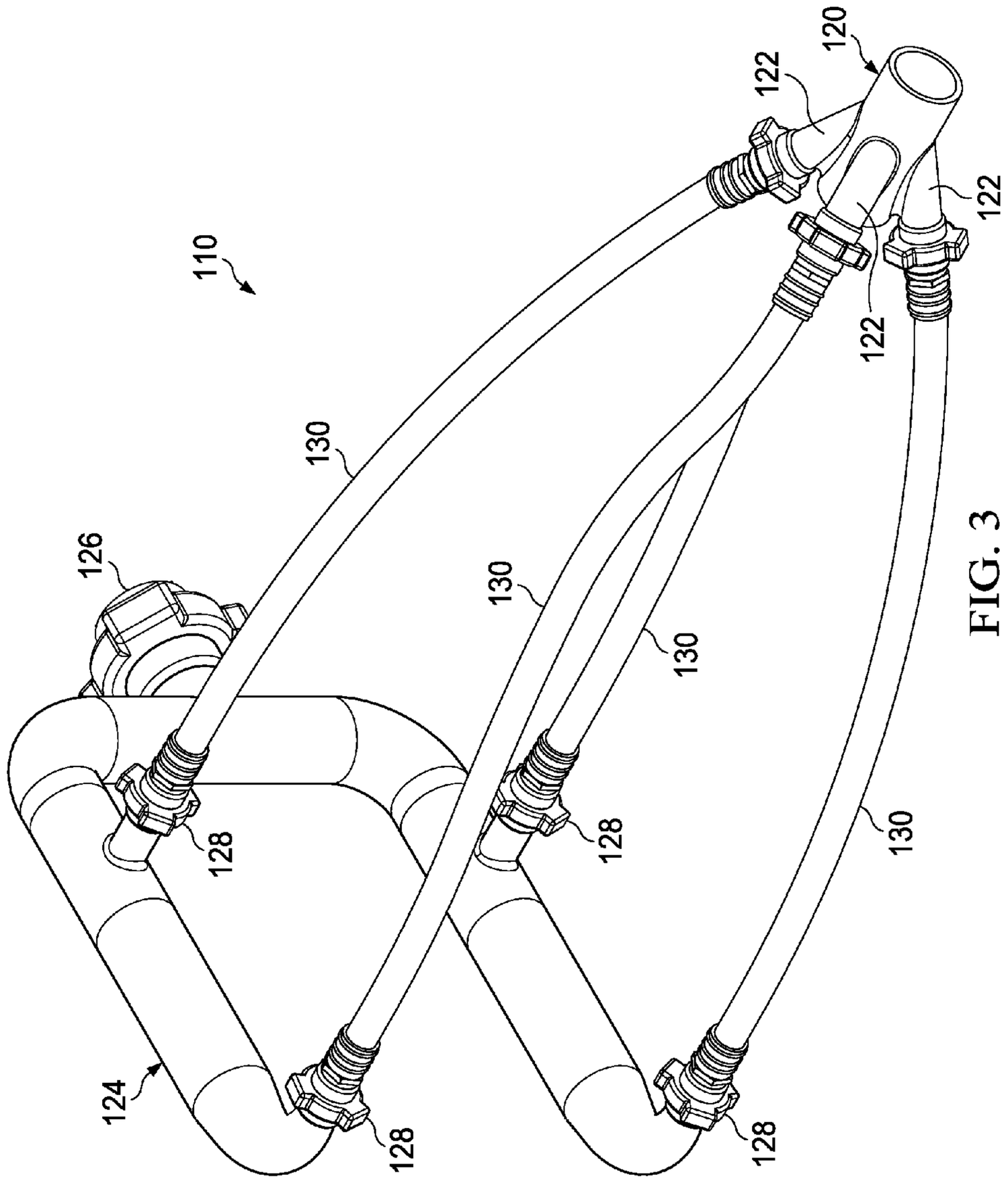


FIG. 3

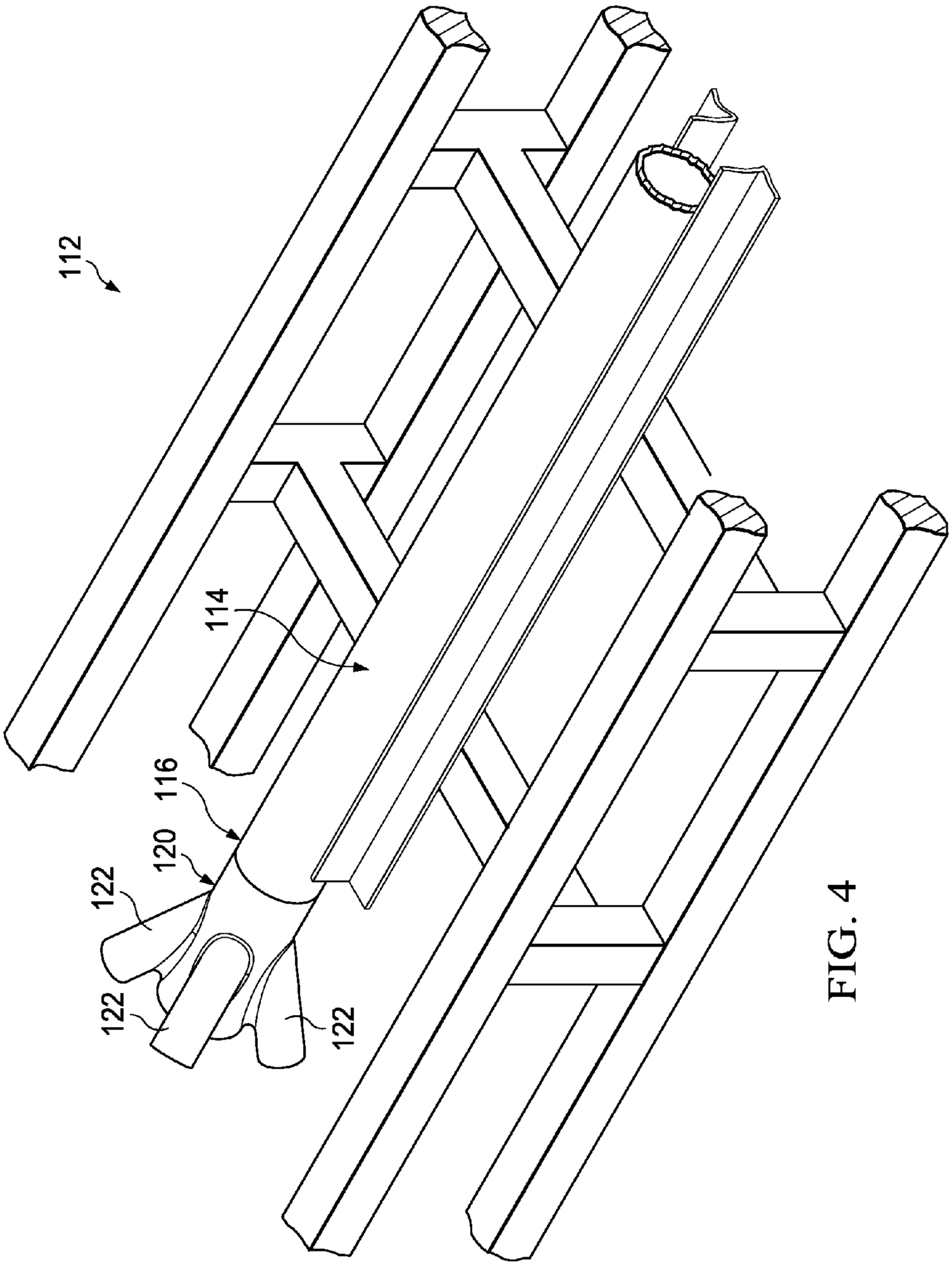


FIG. 4

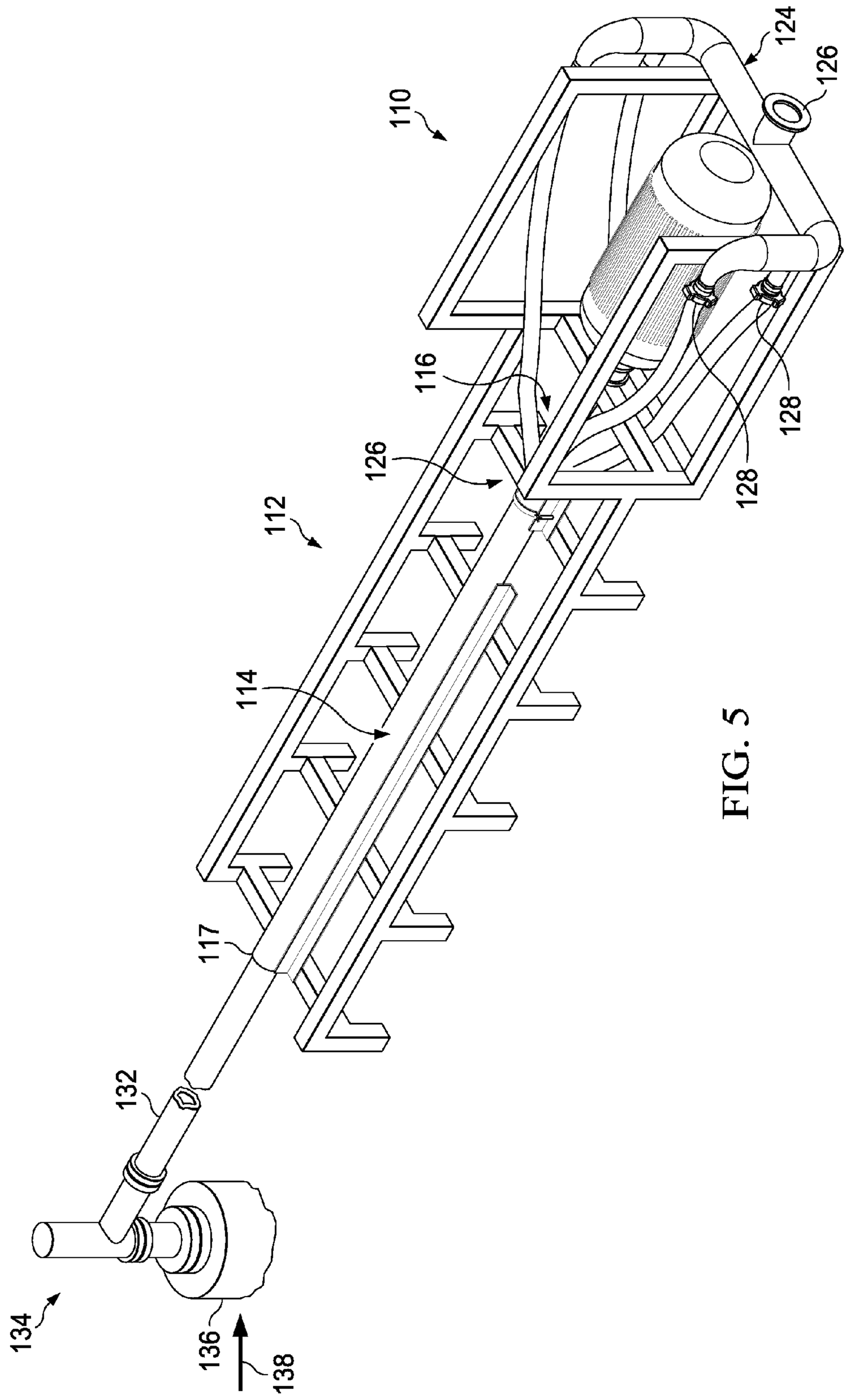


FIG. 5

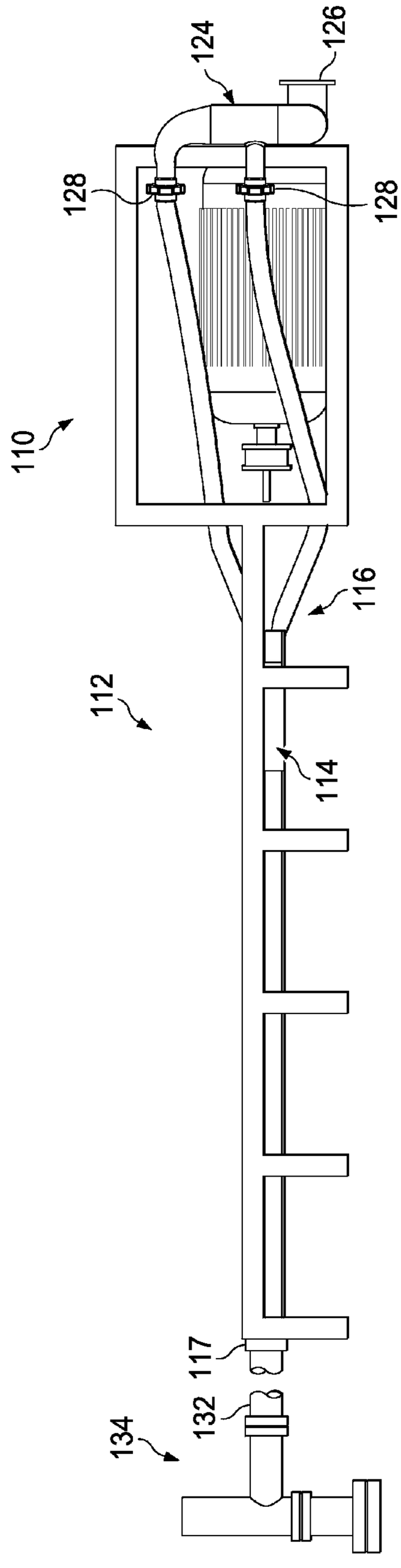


FIG. 6

HIGH FLOW INTAKE SYSTEM FOR SUBMERSIBLE PUMPS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the priority of U.S. Provisional Patent Application No. 61/313,514 entitled "HIGH FLOW INTAKE SYSTEM FOR SUBMERSIBLE PUMPS," filed Mar. 12, 2010, the contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

The invention relates to a high flow intake system. More particularly, the invention relates to an intake system for use with submersible pumps and horizontal pump skid installations for the oil and gas industry.

BACKGROUND OF THE INVENTION

FIG. **1** shows a typical prior art horizontal pump skid installation **10** for the oil and gas industry, which may be used for deep well water injection. Horizontal pump skid installation **10** has a pump **12** having inlet **14** and an outlet **16**. Right angle fitting **20** is provided at pump intake **14**. Right angle fitting **20** results in pressure losses in a typical intake system **18**. In most cases, pressure losses are significant enough to require a boost pump **22** to be installed in series with the main pump **12**. Boost pump **22** is an added expense. However, boost pump **22** is necessary to provide additional inlet pressure to overcome the pressure losses associated with fluid flowing through the 90 degree inlet of right angle inlet fitting **20**. Without boost pump **22**, the main pump **12** could suffer significantly from cavitation issues.

FIG. **2** shows a close-up view of the intake system **18** of the horizontal pump system **10** of FIG. **1**. The arrows highlight the flow path through the 90 degree fitting of right angle fitting **20** that is typical of equipment used throughout the industry for horizontal pump intakes **14**.

SUMMARY OF THE INVENTION

A high flow intake system for a horizontal pump skid installation is provided to avoid pressure drops associated with the prior art. The high flow intake system of the invention includes a horizontal pump body having an intake and an outlet. A pump inlet assembly is proximate the intake. The pump inlet assembly has a collar member and a plurality of inlet members extending from the collar member. In a preferred embodiment, the pump inlet assembly has four inlet members that each protrude from the collar member at a 30 degree angle.

A distribution manifold is provided that has an inlet and a plurality of outlets. A plurality of hoses is provided wherein each of the hoses connects one of the plurality of outlets of the distribution manifold with one of said plurality of inlet members of the collar member. Preferably, each of the hoses has a length that is at least 20 times the inside diameter of the hose so that fluid passing through the hose may develop laminar flow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a typical prior art horizontal pump skid installation used in the oil and gas industry.

FIG. **2** is an enlarged perspective view of the prior art intake system of FIG. **1**.

FIG. **3** is a perspective view of the high flow intake system of the invention.

FIG. **4** is an enlarged perspective view of the collar member of the high flow intake assembly of FIG. **3**, shown installed proximate a pump intake.

FIG. **5** is a perspective view of a horizontal skid pump and high flow intake system of the invention attached to a wellhead;

FIG. **6** is an elevation view of the horizontal skid pump and high flow intake system of the invention attached to a wellhead.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **3** and **4**, a high flow intake system for a horizontal pump skid installation, designated generally **110**, is shown. Horizontal pump skid installation **112** (FIGS. **4-6**) includes a horizontal pump body **114** having an intake **116** and an outlet **117** (FIG. **5**). High flow intake system **110** has a collar member **120** and a plurality of inlet members **122** extending from collar member **120**. Collar member **120** of high flow intake system **110** is proximate pump intake **116**. In a preferred embodiment, intake system **110** has four inlet members **122** that preferably protrude from collar member **120** at an angle between 25° and 45° preferably at a 30 degree angle with respect to a longitudinal axis of pump body **114**.

Distribution manifold **124** (FIGS. **3**, **5**, **6**) is provided having an inlet **126** and a plurality of outlets **128**. A plurality of hoses **130** is provided wherein each of hoses **130** connects one of the plurality of outlets **128** of distribution manifold **124** with one of plurality of inlet members **122** of collar member **120**. As can be seen in FIGS. **5** and **6**, inlet **126** of distribution manifold **124** is oriented approximately parallel to horizontal pump body **114**. Plurality of outlets **128** of distribution manifold **124** are also oriented approximately parallel to horizontal pump body **114**. Preferably, each of hoses **130** has a length that is at least 20 times the inner diameter of hose **130** so that fluid passing through hose **130** may develop laminar flow.

As can be seen in FIG. **3**, the single 90 degree intake of right angle fitting **20** at the pump intake **14** of FIGS. **1** and **2** is replaced by a plurality, e.g., four (4), intakes at inlet members **122**. Inlet members **122** are oriented at an angle to the pump body, i.e., at 25° to 45°, preferably at 30 degrees with respect to a longitudinal axis of collar member **120** and pump body **114**. A length of hose **130** is provided between the distribution manifold **124** and inlet members **122** of high flow intake system **110** that is at least 20 times inner diameter of hose **130** so that fluid passing through hose **130** may develop laminar flow. The "20×" is a common rule of thumb in fluid mechanics that allows the flow to fully develop in the laminar region.

Pump outlet **117** is connected to transfer line **132** (FIGS. **5** and **6**) that is in fluid communication with wellhead **134** of well **138** (FIG. **5**). Well **138** includes casing **136**.

The high flow intake system **110** of the present disclosure eliminates cavitation by allowing the flow incoming to pump body **114** to develop into laminar flow and by reducing the pressure drop across the intake system **110**, which reduces or eliminates the need for a boost pump such as boost pump **22**.

Thus, the present invention is well adapted to carry out the objectives and attain the ends and advantages mentioned above as well as those inherent therein. While presently preferred embodiments have been described for purposes of this disclosure, numerous changes and modifications will be

apparent to those of ordinary skill in the art. Such changes and modifications are encompassed within the spirit of this invention as defined by the claims.

What is claimed is:

1. A high flow horizontal pump skid system comprising:

a distribution manifold having an inlet and a plurality of outlets;

a pump inlet assembly having a collar member that defines a single outlet and plurality of inlet members that receive fluid from said plurality of outlets of said distribution manifold;

a plurality of passages for connecting each of said plurality of outlets to one of said plurality of inlet members, said passages having a length sufficient to develop laminar flow of fluid flowing therein;

a horizontal pump body affixed to said pump inlet assembly for receiving fluid from said outlet of said collar member;

wherein said inlet of said distribution manifold is oriented approximately parallel to said horizontal pump body; and

wherein said plurality of outlets of said distribution manifold is oriented approximately parallel to said horizontal pump body.

2. The high flow pump skid system according to claim **1** wherein:

said plurality of inlet members comprise four inlet members.

3. The high flow pump skid system according to claim **1** wherein:

said plurality of inlet members protrude from said collar member at an angle from a longitudinal axis of said pump body.

4. The high flow pump skid system according to claim **3** wherein:

said angle is between approximately 25° and 45°.

5. The high flow pump skid system according to claim **4** wherein:

said angle is approximately 30°.

6. The high flow pump skid system according to claim **1** wherein:

each of said plurality of passages has a length and an inner diameter; and

said length is at least 20 times said inner diameter so that fluid passing through each of said plurality of passages develops laminar flow.

7. A well comprising:

a distribution manifold having an inlet and a plurality of outlets;

a pump inlet assembly having a collar member that defines a single outlet and plurality of inlet members that receive fluid from said plurality of outlets of said distribution manifold;

a plurality of passages for connecting each of said plurality of outlets to one of said plurality of inlet members, said passages having a length sufficient to develop laminar flow of fluid flowing therein;

a surface mounted horizontal pump body having a longitudinal axis, an intake and an outlet, said intake for receiving fluid from said outlet of said collar member;

an outlet line affixed to said outlet of said horizontal pump body;

a wellhead above a wellbore, said wellhead affixed to said outlet line;

wherein said inlet of said distribution manifold is oriented approximately parallel to said horizontal pump body; and

wherein said plurality of outlets of said distribution manifold is oriented approximately parallel to said horizontal pump body.

8. The well according to claim **7** wherein:

said plurality of inlet members comprise four inlet members.

9. The well according to claim **7** wherein:

said plurality of inlet members protrude from said collar member at an angle from said longitudinal axis of said pump body.

10. The well according to claim **9** wherein:

said angle is between approximately 25° and 45°.

11. The well according to claim **10** wherein:

said angle is approximately 30°.

12. The well according to claim **7** wherein:

each of said plurality of passages has a length and an inner diameter; and

said length is at least 20 times said inner diameter so that fluid passing through each of said plurality of passages develops laminar flow.

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